Carlo Testa, R&D Manager Coatings, Eastman Chemical discusses how research shows that Texanol ester alcohol significantly improves the wet scrub resistance of matte interior wall paints applied at temperatures above the polymer's Tg

Improving wet scrub resistance

As a coalescing aid, Eastman Texanol ester alcohol works by temporarily reducing the glass transition temperature (Tg) of polymers, thus enabling the polymer particles in formulated paint to move and fuse together to create a smooth coherent film. Eastman Chemical Company recently conducted research at its European Technical Centre, testing Texanol in formulations with polymers having a Tg of 14°C and 22°C. The test samples were then dried at both ambient and elevated temperatures. The results show significantly improved wet scrub resistance in all experiments.

WET SCRUB RESISTANCE OF ARCHITECTURAL PAINT SYSTEMS

Wet scrub resistance is a paint film's ability to withstand wet abrasive cleaning without removing paint from the surface. This resistance is often directly related to the type of binder and the binder-to-pigment/extender ratio in paint. Generally speaking, wet scrub resistance increases with the amount of binder used (although the level and type of extenders and pigments also play key roles).

Wet scrub resistance can also be severely reduced if the paint is not sufficiently coalesced or, in the case of coalescent-free systems, if the binders are too soft and/or there is insufficient crosslinking within the binder*.

TECHNICAL EVALUATIONS

The aim of this evaluation was to understand the effect of application temperatures on film formation and consequently the wet scrub resistance when paint was applied at temperatures that were above a polymer's Tg. Several paints were formulated with and without Texanol and applied on to Leneta charts at 23°C and 40°C.

The formulated paints (**Appendix 1: Tables 1, 2**) were based on Acronal S 790, a styrene acrylic binder from BASF, with a Tg of 22°C and VV673 a Va/VeoVa binder from Synthomer, with a Tg of 14°C. The two paints were divided into three parts. Two parts had Texanol added at 0.57% and 1.16% on total weight of paint; and the third sample had no coalescent added. (The 0.57% level is half the typically recommended coalescent addition level.)

The wet scrub resistance of the paints was determined via the ASTM D2486 method (**Appendix 2**) to assess the integrity of the films formed at the varying application temperatures after two and six weeks (**figure 1, 2**).

RESULTS

As shown in **figures 1** and **2**, the results were improved wet scrub resistance in both experimental paint formulations.

Benefits of Texanol ester alcohol demonstrated in this evaluation include:

- Wet scrub resistance was improved when paint was applied at temperatures that were higher than the Tg of the polymers.
- This increase of wet scrub resistance was more prominent at 40°C.
- Results are polymer dependent and in our research the

Fig 1. Wet scrub resistance of matte wall paints formulated with Acronal S 790[1] according to ASTM D2486

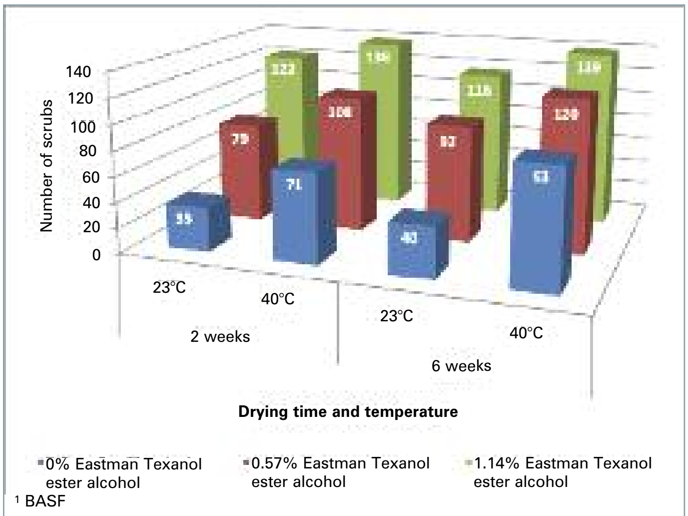
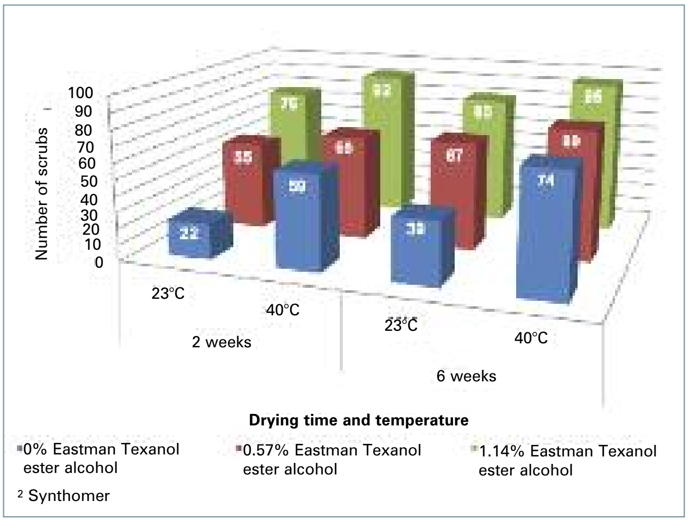


Fig 2. Wet scrub resistance of matte wall paints formulated with Emultex VV673[2] according to ASTM D2486



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paints formulated with Acronal S790 gave better wet scrub resistance than the Emultex VV673 formulations.

- Wet scrub resistance increased with time. Paints aged for six weeks showed the highest values.

CONCLUSION

In this technical tip, we have demonstrated that interior matt wall paints containing Eastman Texanol ester alcohol have shown much improved wet scrub resistance when applied at ambient temperatures in excess of the Tg of polymers. It is theorised the mobility of Texanol to partition deeper into the polymer phase of the coating is increased by increasing the ambient application temperature above the Tg of the polymer; and consequently, the degree of coalescence is improved. Further research would be needed to confirm this theory.

Appendix 1. Paint formulations

Table 1. Experimental matte formulation–Acronal S 790 (50% NV) (pH 8.75 at 23°C)

Ingredient	Amount	Type	Supplier
Deionised Water	121.4	-	-
Dispex A 40	5.1	Dispersant	BASF
Ammonia (25%)	1.0	pH Control	VWR
Acticide MBS	2.0	Biocide	Thor Specialities
Foamaster NDW	2.0	Defoamer	BASF
Tiona 595	98.1	White Pigment	Cristal Global
Snowcal 70	216.5	Filler	OMYA
Satintone 5HB	51.6	Filler	Lawrence Industries
Dispersed until Hegman grind <30µm			
Bermocoll E 320 FQ (3% Solution in Water)	214.4	Cellulose Thickener	Akzo Nobel
Deionised Water	62.3	-	-
Sodium Benzoate	1.0	pH Regulator	VWR
Ropaque Ultra	70.8	Opacity Enhancer	Dow
Acronal S 790 (50%)	143.6	Binder	BASF
Acrysol TT 935	10.1	Thickener	Dow
Total	**1000.0**		

Table 2. Experimental matte formulation–Emultex VV673 (55% NV) (pH 8.95 at 23°C)

Ingredient	Amount	Type	Supplier
Deionised Water	121.4	-	-
Dispex A 40	5.1	Dispersant	BASF
Ammonia (25%)	1.0	pH Control	VWR
Acticide MBS	2.0	Biocide	Thor Specialities
Foamaster NDW	2.0	Defoamer	BASF
Tiona 595	98.1	White Pigment	Cristal Global
Snowcal 70	216.5	Filler	OMYA
Satintone 5HB	51.6	Filler	Lawrence Industries
Dispersed until Hegman grind <30µm			
Bermocoll E 320 FQ (3% Solution in Water)	214.4	Cellulose Thickener	Akzo Nobel
Deionised Water	75.4	-	-
Sodium Benzoate	1.0	pH Regulator	VWR
Ropaque Ultra	70.8	Opacity Enhancer	Dow
Emultex VV673 (55%)	130.6	Binder	Synthomer
Acrysol TT 935	10.1	Thickener	Dow
Total	**1000.0**		

Appendix 2: Standard operating procedures

Wet scrub resistance

Leneta P121-10N black wet scrub test panels were coated with the formulations using a No.8 K-bar, which delivered 100 m Wet Film Thickness (WFT). One set of panels was aged for two and six weeks at 23°C. A second set of panels was prepared with the paint pre-heated to 40°C. Immediately after these panels were drawn down, they were transferred to a fan assisted oven and aged for two and six weeks at 40°C. All the panels were aged in the same oven. The samples without coalescent were placed in the oven first and allowed to dry before the samples containing Eastman Texanol ester alcohol were added.

Following the ageing periods, wet scrub resistance testing was carried out on a Sheen Instruments Wet Abrasion Tester 903/2. Ten grams of Leneta standardized abrasive wet scrub medium (SC2) and 5 mL of deionized water was applied to the brushes and panels every 400 scrubs in accordance with ASTM D2486. The end point was determined as the number of cycles required to remove a continuous line of paint across the area covered by the two brass shims (12.7 x 0.25 mm) placed under the test panels. The results reported are the average of two determinations on duplicate panels.

Appendix 3. Basic polymer information

Polymer name	Polymer type	Solids content (%)	Viscosity (mPa s)	pH	Glass transition temperature (Tg)
Acronal S790	Styrene Acrylate	49 - 51	700-1500	7.5 - 9.0	22 °C
Emultex VV673	Acrylic Ester VA/VeoVa10/acrylate	54 – 56	500 - 1,500	4.5 - 5.5	14 °C